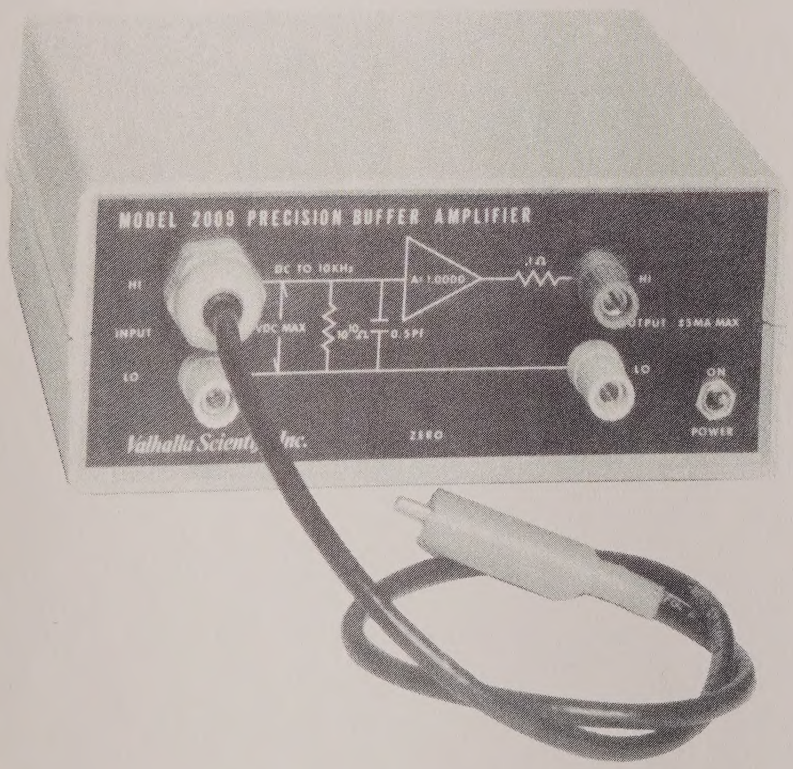
VALHALLA
SCIENTIFIC

2009

Buffer Amplifier

Instruction Manual



VALHALLA SCIENTIFIC

9955 Mesa Rim Road
San Diego, California 92121
(619) 457-5576
Telex 181750

Revision 7/85

CERTIFICATION

Valhalla Scientific, Inc. certifies that this instrument was thoroughly tested and inspected and found to meet its published specifications when it was shipped from the factory. Valhalla Scientific, Inc. further certifies that its calibration measurements are traceable to the National Bureau of Standards to the extent allowed by NBS's calibration facility.

SPECIFICATIONS

Gain:	+1.000 ±0.03%.
Input Resistance:	1 X 1010 ohms minimum.
Input Capacitance:	1 pfd. maximum, 0.5 pfd. typical.
Bandwidth:	DC to 10 KHz, 0.05%.
Maximum Input:	±3VDC or Peak AC.
Output Resistance:	1 ohm maximum, 0.1 ohm typical.
Size:	6 in.wide,2-1/2 in.high,6 in.deep.
Weight:	2 lbs.
Power Requirements:	Two 9 volt alkaline transistor batteries.

SECTION I

PREPARATION FOR USE

2-1 INITIAL INSPECTION

2-2 If the external shipping container shows evidence of in-transit damage, such damage should be immediately brought to the attention of the carrier and noted on the bill of lading.

2-3 Retain the shipping container until the unit has been inspected for possible damage in shipment. If in-shipment damage is observed, notify the carrier and obtain his authorization for repairs before returning the unit to the factory. When the external shipping container shows evidence of damage in transit, but the unit shows no external damage, it may be advisable to check its operation to determine that it has not incurred hidden damage.

2-4 POWER REQUIREMENTS

2-5 The Model 2009 is powered by two 9 volt transistor batteries that are supplied with the unit. These are connected at time of delivery and are retained on the circuit board with cable wrap devices. Batteries may be replaced by removing the two screws through the bottom of the case that hold the cover in place. The cover may then be lifted clear to provide access to the batteries.

NOTE

Use alkaline batteries only.

SECTION III

OPERATION

3-1 GENERAL

3-2 The Valhalla Model 2009 Buffer Amplifier has a direct coupled input and will accurately reproduce the input signal from DC to 10 KHz. Signal levels should not exceed ± 3 volts DC to peak AC. Amplifier gain is unity, therefore the output will be an exact reproduction of the input.

3-3 The amplifier is self-powered with two internal 9-volt batteries and may be floated above ground. The input and output low terminals are interconnected and the amplifier output drives an internal guard shield to reduce input capacity to 0.5 picofarads. Input impedance is in the order of 10^{10} ohms, reducing circuit loading to an absolute minimum.

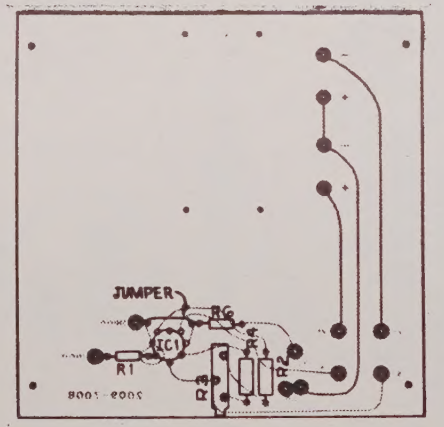
3-4 ZERO ADJUSTMENT

3-5 Prior to operating the Model 2009, connect a DVM to the output. Short the input terminals and turn the unit on. Insert a small screwdriver through the front panel ZERO opening and adjust the control for a reading on the DVM of ±100 microvolts, or less. If the voltages of the two batteries change with respect to each other, due to aging, it may be necessary to readjust the ZERO control.

3-6 OPERATION

3-7 To operate the Model 2009, connect the input to the signal to be measured and the output to the DVM, oscilloscope or other instrument. When the power switch is placed in the 'ON' position, the input signal will be reproduced at the output.

REVISIONS				
ECO	LTR	DESCRIPTION	DATE	APPROVED
738	C	REDRAWN — RDN	7-9-85	



DASH NO	QTY REQD	NEXT ASSE	USED ON

TOLERANCES
X = ± 30'
.XX = ± 03
.XXX = ± 010

MATERIAL

BREAK ALL SHARP CORNERS AND EDGES. MACH SURFACES 64

FINISH

DRAWN RDN	7-9-85	
CHECKED CRE	7-9-85	
APPR RDN	7-9-85	
STK NO		

Valhalla Scientific Inc.
SAN DIEGO, CA

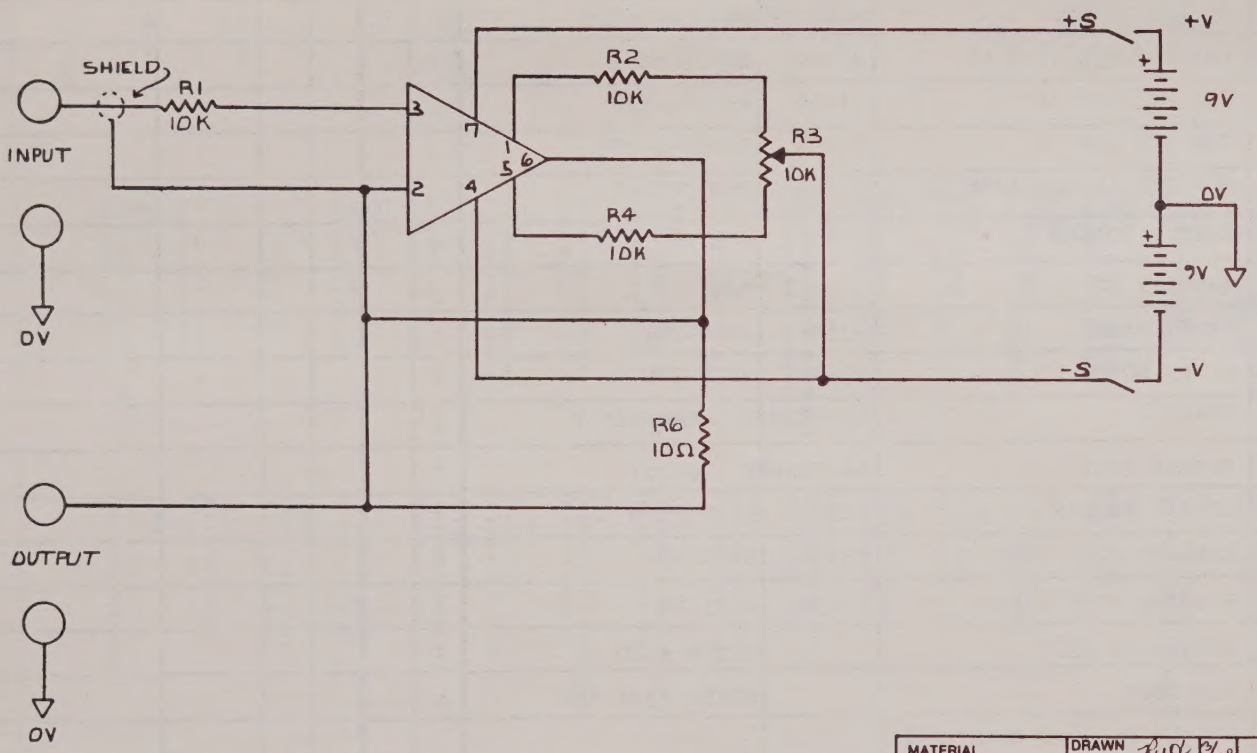
THE INFORMATION DISCLOSED HEREIN WAS ORIGINATED BY AND IS THE PROPERTY OF VALHALLA SCIENTIFIC INC. AND EXCEPT FOR INTER-COMPANY USE IS NOT TO BE DISCLOSED, COPIED OR USED WITHOUT THE WRITTEN PERMISSION OF VALHALLA SCIENTIFIC INC.

2009 P.C.B. ASSEMBLY

SCALE	CODE IDENT	SIZE	DRAWING NO	REV
1 : 1	53504	C	2009-600	C

SHEET 1 OF 1

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



MATERIAL	DRAWN RWF 3/78	Valhalla Scientific Inc. SAN DIEGO, CALIFORNIA			
	CHECKED				
	APPR.				
FINISH	THE INFORMATION DISCLOSED HEREIN WAS ORIGINATED BY AND IS THE PROPERTY OF VALHALLA SCIENTIFIC INC. AND EXCEPT FOR RIGHTS EXPRESSLY GRANTED TO THE UNITED STATES GOVERNMENT VALHALLA SCIENTIFIC INC. RESERVES ALL PATENT, SALE, PROPRIETARY DESIGN, MANUFACTURING USE AND REPRODUCTION RIGHTS THERETO	MODEL 2069 BUFFER AMPLIFIER			
	SCALE NONE	CODE IDENT NO. 53504	SIZE B	DRAWING NO. 2009-070	REV. B
	SHEET 1 OF 1				

Valhalla Scientific Inc.

PARTS LIST

PRECISION BUFFER AMPLIFIER | MODEL 2009 | DWG NO 2009-400 | REV C

#	REF DES	VALHALLA PART NO	DESCRIPTION	CODE IDENT	MFG PART NO	QTY. I	QTY. N				REMARKS
	I C1	3-30328	IC FET OP AMP	BURR-BROWN	OPA103AM	1					
	R1	1-01061	RES FXD 10K 1/4W 5%	81349	RC07GF103J	1					
	R2, 4	1-10008	RES FXD 10K 1%	81349	RN60C1002F	2					
	R3	1-50023	RES VAR 10K	80294	3006P-1-103	1					
	R6	1-01007	RES FXD 10 ohm 1/4W 5%	81349	RC07GF10RJ	1					
	S1	5-03015	SWITCH TOGGLE	TEC	1201	1					
		5-10083	BATTERY 9V		522	2					
		4-10129	FRONT PANEL	53504	2009-201	1					
		4-30036	P. C. BOARD	53504	2009-700	1					
		4-10128	CHASSIS	LA FRANCE	CM6-225 T	1					
		4-10128	RUBBER FEET	LA FRANCE	60221	4					
		5-10118	STRAIN REFIEF	LAPP	LAPP SL-9	1					
		5-10002	BINDING POST (WHT)	83330	BP21 WTC	2					
		5-10001	BINDING POST (RED)	83330	BP21 RC	1					
		5-10120	ALLIGATOR CLIP		SMITH #380	1					
		5-10121	RED BOOT		SMITH #331 RED	1					
			24" LG RG 58/U COAX CABLE			1					
		4-10035	GUARD COVER	53504	2009-202	1					
		4-10442	REAR PANEL	53504	2009-203	1					
		5-10402	BATTERY HOLDER	ACME	154	1					
			WIRE BLK. 22AWG		12" 22 AWG	1					
			WIRE RED 22AWG		12" 22 AWG	1					
			#4 X 3/8" LG SELF-TAPPING	SCREW		1					
			#4 X 1/4" LG SELF-TAPPING	SCREW		3					

NOTES:

Federal Supply Codes for Manufacturers

00656
Aerovox Corp
New Bedford, Massachusetts

00686
Film Capacitors, Inc
Passaic, New Jersey

00779
AMP Inc.
Harrisburg, Pennsylvania

00853
Sangamo Electric Company
Pickens, South Carolina

01121
Allen-Bradley Co.
Milwaukee, Wisconsin

01255
Litton Industries, Inc.
Beverly Hills, California

01281
TRW Electronic Comp.
Semiconductor Operations
Lawndale, California

01295
Texas Instruments, Inc.
Dallas, Texas

01686
RCL Electronics Inc.
Manchester, New Hampshire

02114
Ferroxcube Corp.
Saugerties, New York

02131
General Instrument Corp.
Westwood, Maine

02799
Areo Capacitors Inc.
Chatsworth, California

03508
General Electric Co
Syracuse, New York

03797
Genisco Technology Corp.
Compton, California

03877
Transistron Electronic Corp.
Wakefield, Massachusetts

03911
Clairex Corp.
Mt. Vernon, New York

04009
Arrow Hart Inc.
Hartford, Connecticut

04217
Essex International Inc.
Anaheim, California

04222
AVX Corp
Myrtle Beach, Florida

04423
Telonic Industries
Laguna Beach, California

04713
Motorola Inc
Phoenix, Arizona

04946
Standard Wire & Cable
Los Angeles, California

05276
Pomona Electronics Co., Inc.
Pomona, California

05277
Westinghouse Electric Corp.
Youngwood, Pennsylvania

05397
Kemet, Union Carbide Corp
New York, New York

05574
Viking Industries
Chatsworth, California

05820
Wakefield Engineering Inc.
Wakefield, Massachusetts

06001
General Electric Co.
Columbia, South Carolina

06383
Panduit Corp
Tinley Park, Illinois

06473
Bunker Ramo Corp.
Chatsworth, California

06555
Beede Electrical Instrument Co.
Penacook, New Hampshire

06743
Clevite Corp.
Cleveland, Ohio

07088
Kelvin Electric Company
Van Nuys, California

07256
Silicon Transistor Corp.
Chelmsford, Massachusetts

07263
Fairchild Semiconductor
Mountain View, California

07344
Bircher Co., Inc.
Rochester, New York

07597
Burndy Corp.
Rochester, New York

07716
I R C Incorporated
Burlington, Iowa

07910
Teledyne Semiconductor
Hawthorne, California

08065
Accurate Rubber and Plastics Co
San Diego, California

08261
Spectra Strip Corp
Garden Grove, California

08530
Reliance Mica Corp
Brooklyn, New York

08806
General Electric Co.
Cleveland, Ohio

09026
Babcock Electronics Corp.
Costa Mesa, California

09214
G E. Co. Semi-Conductor
Auburn, New York

09353
C and K Components
Watertown, Massachusetts

09922
Burndy Corp.
Norwalk, Connecticut

09969
Dale Electronics Inc.
Yankton, S. Dakota

11236
CTS of Berne
Berne, Indiana

11403
Best Products Co.
Chicago, Illinois

11503
Keystone Columbia Inc.
Warren, Michigan

11532
Teledyne Relays
Hawthorne, California

11711
General Instrument Corp.
Hicksville, New York

12014
Chicago Rivet & Machine Co.
Bellwood, Illinois

12060
Diodes, Inc.
Chatsworth, California

12136
Philadelphia Handle Co.
Camden, New Jersey

12405
Hysol Corporation
El Monte, California

12406
Elpac, Incorporated
Fullerton, California

12615
U.S Terminals Inc.
Cincinnati, Ohio

12617
Hamlin Inc.
Lake Mills, Wisconsin

12697
Clarostat Mfg. Co
Dover, New Hampshire

12969
Unitrode Corp.
Watertown, Massachusetts

13103
Thermalloy Co., Inc
Dallas, Texas

13327
Solitron Devices Inc
Tappan, New York

13454
Texas Crystals
River Grove, Illinois

13511
Amphenol Cadre Div
Los Gatos, California

13606
Use 56289
Sprague Electric Co.
Concord, New Hampshire

14099
Semtech Corp
Newbury Park, California

14655
Cornell-Dublier Electronics
Newark, New Jersey

14752
Electro Cube Inc.
San Gabriel, California

14936
General Instrument Corp
Hicksville, New York

15801
Fenwal Electronics Inc
Framingham, Massachusetts

15818
Teledyne Semiconductors
Mountain View, California

15849
Useco Inc.
Van Nuys, California

15898
International Business
Machines Corp.
Essex Junction, Vermont

16332
Replaced by 28478

16473
Cambridge Scientific Ind
Cambridge, Maryland

16758
Delco Electronics
Kokomo, Indiana

17856
Siliconix, Inc
Santa Clara, California

18324
Signetics Corp
Sunnyvale, California

Federal Supply Codes for Manufacturers (cont.)

18612
Vishay Intertechnology Inc
Malvern, Pennsylvania

18722
R C A
Mountaintop Pennsylvania

18927
GTE Sylvania Inc
Titusville, Pennsylvania

21604
Bucheye Stamping Co.
Columbus, Ohio

21845
Solitron Devices Inc
Riveria Beach, Florida

22767
ITT Semiconductors
Palo Alto, California

23936
Pamotor Div
Burlingham, California

24355
Analog Devices Inc
Norwood, Massachusetts

24655
General Radio
Concord, Massachusetts

25088
Siemen Corp.
Isilen, New Jersey

25403
Amperex Electronic Corp.
Slatersville, Rhode Island

25684
Victoreen Instrument Co., Inc.
Oak Lawn, Illinois

27014
National Semiconductor Corp.
Santa Clara, California

27556
IMB Electronic Products
Santa Fe Springs, California

27264
Molex Products
Downers Grove, Illinois

28213
Minnesota Mining & Mfg. Co.
St. Paul, Minnesota

28480
Hewlett Packard Co.
Palo Alto, California

29083
Monsanto Co., Inc
Santa Clara, California

29604
Stackpole Components Co.
Raleigh, North Carolina

30323
Illinois Tool Works, Inc.
Chicago Illinois

30983
Electra/Midland
San Diego California

32539
Mura Corp
Great Neck, New York

32897
Erie Technological Products, Inc.
Carlisle, Pennsylvania

32997
Bourns Inc
Riverside, California

33173
General Electric Co.
Owensboro, Kentucky

34333
Silicon General
Westminister, California

34335
Advanced Micro Devices
Sunnyvale, California

34802
Electromotive Inc.
Kenilworth, New Jersey

37942
P.R. Mallory & Co., Inc.
Indianapolis, Indiana

43543
Nytronics Inc.
Geneva, New York

44655
Ohmite Mfg. Co.
Skokie, Illinois

49671
RCA Corp.
New York, New York

49956
Raytheon Company
Lexington, Massachusetts

50088
Mostek Corp.
Carrollton Texas

50579
Litronix Inc.
Cupertino, California

51605
Scientific Components Inc.
Linden, New Jersey

53021
Sangamo Electric Co.
Springfield, Illinois

53504
Valhalla Scientific, Inc.
San Diego, California

54294
Cutler-Hammer Inc.
Selma, North Carolina

55026
Simpson Electric Co.
Elgin, Illinois

56289
Sprague Electric Co
North Adams, Massachusetts

58474
Superior Electric Co
Bristol, Connecticut

63743
Ward Leonard Electric Co., Inc.
Mount Vernon, New York

65092
Weston Instruments Inc
Newark, New Jersey

70563
Amperite Company
Union City, New Jersey

70903
Belden Corp.
Geneva, Illinois

71279
Cambridge Thermionic Corp.
Cambridge, Massachusetts

71400
Bussmann Mfg.
Saint Louis, Missouri

71450
CTS Corp.
Elkhart, Indiana

71468
ITT Cannon Electric Inc.
Santa Ana, California

71482
Clare, C.P. & Co.
Chicago, Illinois

71590
Centrelab Electronics
Milwaukee, Wisconsin

71707
Coto Coil Co., Inc.
Providence, Rhode Island

71744
Chicago Miniature Lamp Works
Chicago, Illinois

71785
TRW Electronics Components
Chicago, Illinois

72005
Wilber B. Driver Co.
Newark, New Jersey

72259
Nytronics Inc.
Pelham Manor, New Jersey

72619
Dialight Div.
Brooklyn, New York

72982
Erie Tech. Products Inc.
Erie, Pennsylvania

73138
Bechman Instrument Inc.
Helipot Division
Fullerton, California

73445
Amperex Electronic Corp.
Hicksville, New York

73734
Federal Screw Products, Inc
Chicago, Illinois

73899
JFD Electronics Co
Brooklyn, New York

73949
Guardian Electric Mfg. Co
Chicago, Illinois

74276
General Instrument Corp
Neptune, New Jersey

74306
Piezo Crystal Co
Carlisle, Pennsylvania

74970
Johnson E F. Co
Waseca, Minnesota

75042
TRW Electronics Components
IRC Fixed Resistors
Philadelphia, Pennsylvania

75378
CTS Knights Inc
Sandwich, Illinois

75382
Kulka Electric Corp.
Mount Vernon, New York

75915
Littlefuse Inc.
Des Plaines, Illinois

76055
Mallory Controls
Frankfort, Indiana

76493
J.W. Miller Company
Los Angeles, California

76854
Oak Industries Inc
Crystal Lake Illinois

77342
Potter & Brumfield Div
Princeton, Indiana

77638
General Instrument Corp
Rectifier Division
Brooklyn, New York

78488
Stackpole Carbon Co
Saint Marys, Pennsylvania

78553
Eaton Corp
Cleveland, Ohio

80031
Electro-Midland Corp
Mepco Div
Norristown New Jersey

56289
Sprague Products
North Adams, Massachusetts

80294
Bourns Inc., Instrument Div
Riverside California

81073
Grayhill Inc
La Grange Illinois

Federal Supply Codes for Manufacturers (cont.)

81095
Triad Transformer Corp.
Venice, California

81312
Winchester Electronics
Div. of Litton Industries Inc.
Oakville, Connecticut

81483
International Rectifier Corp.
Los Angeles, California

81741
Chicago Lock Co.
Chicago, Illinois

82389
Switchcraft Inc.
Chicago, Illinois

82877
Rotron Inc.
Woodstock, New York

82879
ITT Royal Electric Div.
Pawtucket, Rhode Island

83003
Varo Inc.
Garland, Texas

83298
Bendix Corp.
Eatontown, New Jersey

83330
Herman H. Smith, Inc.
Brooklyn, New York

83594
Burroughs Corp.
Plainfield, New Jersey

83740
Union Carbide Corp.
New York, New York

84171
Arco Electronics
Great Neck, New York

84411
TRW Electronic Components
Ogallala, Nebraska

84613
Fuse Indicator Corp.
Rockville, Maryland

84682
Essex International Inc.
Peabody, Massachusetts

86684
Radio Corp. of America
Harrison, New Jersey

88219
Gould Inc.
Trenton, New Jersey

88245
Litton Systems Inc.
Useco Div.
Van Nuys, California

88419
Cornell-Dubilier Electronic Div.
Fuquay-Varian, North Carolina

89730
G.E. Co.
Newark, New Jersey

90201
Mallory Capacitor Co.
Indianapolis, Indiana

56365
Square D Co.
Chicago, Illinois

90303
Mallory Battery Co.
Tarrytown, New York

91094
Essex International Inc.
Newmarket, New Hampshire

91293
Johanson Mfg. Co.
Boonton, New Jersey

91506
Augat Inc.
Attleboro, Massachusetts

91637
Dale Electronics Inc.
Columbus, Nebraska

91662
Elco Corp.
Willow Grove, Pennsylvania

71468
Gremar Mfg. Co., Inc.
ITT Cannon/Gremar
Santa Ana, California

91802
Industrial Devices, Inc.
Edgewater, New Jersey

91833
Keystone Electronics Corp.
New York, New York

91929
Honeywell Inc.
Micro Switch Div.
Freeport, Illinois

92194
Alpha Wire Corp.
Elizabeth, New Jersey

93332
Sylvania Electric Products
Woburn, Massachusetts

94988
Wagner Electric Corp.
Tung-Sol Div.
Newark, New Jersey

95146
Alco Electronic Products Inc.
Lawrence, Massachusetts

95275
Vitramon Inc.
Bridgeport, Connecticut

95303
RCA Corp.
Receiving Tube Div.
Cincinnati, Ohio

95348
Gordo's Corp.
Bloomfield, New Jersey

95712
Bendix Corp.
Franklin, Indiana

97913
Industrial Electronic
Hardware Corp.
New York, New York

97945
Penwalt Corp.
SS White Industrial Products Div.
Piscataway, New Jersey

98278
Malco A. Microdot Co., Inc.
Connector & Cable Div.
Pasadena, California

98291
Sealectro Corp.
Mamaroneck, New York

98388
Royal Industries
Products Div.
San Diego, California

98978
IERC
Burbank, California

99120
Plastic Capacitors, Inc.
Chicago, Illinois

99217
Bell Industries Elect.
Burbank, California

99392
STM
Oakland, California

99515
ITT Jennings Monrovia Plant
Monrovia, California

99779
Use 29587
Bunker-Ramo Corp.
Landsdowne, Pennsylvania

99942
Centrelab Semiconductor
El Monte, California